Keeping Up with DNA Technology

While still in its infancy, the DNA technology that is available to seedstock cattle producers is expanding at a rapid rate. DNA represents the next generation of genetic technology and coupled with existing technologies, promises to offer the seedstock industry with the ability to increase the rate of genetic improvement over and beyond what is currently being achieved.

So how can seedstock cattle producers make use of DNA technology within their enterprise? The following article provides an update on the DNA technology that is currently available to seedstock cattle producers in Australia.

- **Parentage Verification:** The most common use of DNA technology at present is for parent verification. Parentage verification offers producers the ability to confirm the sire and/or dam of a particular calf. For example, the ability to identify the sire from multiple sire joinings, to identify whether the AI sire or the back up bull sired the calf in artificial breeding programs, and to reduce pedigree errors caused by such things as human errors, cross mothering and bulls jumping the fence. In order to maintain the integrity of their pedigree information, most Breed Societies now also have regulations relating to parent verification. Parentage verification services are available in Australia through DNA labs such as the University of Queensland and Pfizer Animal Genetics.

- **Genetic Disorder Management:** DNA tests are available to identify visually normal animals that are “carriers” of genetic defects. The most recent and widely publicised genetic defects have been Arthrogryposis Mutiplex (AM) and Neuropathic Hydrocephalus (NH) in Angus cattle, however genetic defects exist in almost all other breeds. For example, Pompes Disease in Brahman and Shorthorn, Mannosidosis in Red Angus, Murray Grey and Salers, and Protoporphyria in Limousin just to name a few. Using DNA to identify “carrier” animals enables these genetic defects to be carefully managed by seedstock breeders. Similarly to parentage verification, DNA tests for genetic defects are available through University of Queensland (in conjunction with Elizabeth Macarthur Agricultural Institute) and Pfizer Animal Genetics.

- **Selection for Type Traits:** DNA tests are available to identify animals that are “homozygous” for type traits such as coat colour (black or red) and horn status (horn or poll). For example, breeders interested in increasing the frequency of polled animals within their herd can use a DNA test to identify polled animals that carry two polled alleles (rather than one) and who therefore will produce 100% polled progeny. DNA tests are currently only available in Australia for coat colour with both the University of Queensland and Pfizer Animal Genetics offering a test. While not available in Australia, a horn status test is available for several breeds in the United States through two DNA companies, Igenity and MetaMorphix. The Beef CRC have also recently publicised that they have developed a horn status test and are currently liaising with DNA labs about making this test available in Australia.

- **Improvement of Production Traits:** DNA tests are available that use gene markers to identify genetically superior animals for economically important production traits. DNA tests for production traits are available in Australia through Pfizer Animal Genetics (marbling, tenderness and feed efficiency) and University of Queensland (myostatin - associated with increased muscling).
Several overseas DNA companies also offer tests for production traits including Igenity (retail beef yield, rib eye area, back fat thickness, marbling, tenderness, percent choice, stayability, pregnancy rate, calving ease, average daily gain, feed efficiency, docility and myostatin) and MetaMorphix (marbling and tenderness). The DNA tests that are available provide an estimate of an animal’s breeding value for each production trait from gene marker information alone.

In contrast to the other applications of DNA technology, use of gene markers to identify genetically superior animals for important production traits has become increasingly challenging as the technology has developed. Initially it was thought that a few gene markers would be sufficient to identify a significant portion of the genetic variation in economically important traits. However, it is now apparent that for most traits this concept was oversimplified and many hundreds, possibly thousands of gene markers will be required to adequately identify a significant portion of the genetic variation for each trait. Coupled with this, additional difficulties have been identified such as gene markers having different associations with the trait of interest in different populations of animals (e.g. different breeds). These challenges have slowed the commercialisation of DNA tests for production traits with the scientific community now believing that the optimal use of the results from these DNA tests will be to include them into the existing BREEDPLAN analysis to increase the accuracy of the Estimated Breeding Values (EBVs) that are currently calculated.

Importantly, most of the commercially available DNA tests for production traits have been independently assessed so that seedstock producers can assess the usefulness of a particular DNA test when deciding whether to test their animals. Independent assessment results of the tests that are available in Australia are displayed on the Beef CRC website (www.beefcrc.com.au) while independent assessment results in the United States are available on the NBCEC website (www.nbcec.org).

While the above provides a brief overview of the current DNA technology that is available to beef producers in Australia, as time progresses, the magnitude of DNA technology available is likely to increase exponentially. The challenge for seedstock cattle producers will be to carefully select which DNA technology they invest in to ensure that they harness the benefits offered by DNA in the most cost effective manner possible. For further advice on the use on DNA technology within your herd, please do not hesitate to contact staff at SBTS or TBTS.

Revision to Days to Calving EBVs

The information that is required for the calculation of the Days to Calving EBV has recently been reviewed by both the Animal Genetics & Breeding Unit (AGBU) and the BREEDPLAN Technical Liaison Group (BTLG).

Resulting from this review, there have been significant modifications made to a) the information that needs to be submitted by members interested in having Days to Calving EBVs calculated for their animals, and b) the methods that should be used to submit this information for inclusion in the calculation of Days to Calving EBVs. Complete details of the revised information that is now required are outlined in the tip sheet titled “Understanding Days to Calving EBVs” that is available from the technical area of the BREEDPLAN website (http://breedplan.une.edu.au).

Days to Calving EBVs are currently calculated within the GROUP BREEDPLAN analysis that is conducted for Angus, Hereford, Brahman, Santa Gertrudis, Limousin, Simmental and Murray Grey. The Days to Calving EBV relates to female fertility and provides estimates of genetic differences between females in the time from the start of the joining period (i.e. when the female is introduced to a
Southern Beef Technology Services (SBTS) & Tropical Beef Technology Services (TBTS) provide technical support to beef producers in the use and understanding of the different genetic technologies that are available.

Any member that is interested in having Days to Calving EBVs calculated for their animals is now strongly encouraged to submit joining information directly to BREEDPLAN. Members with historical information are also encouraged to contact staff at either SBTS, TBTS or BREEDPLAN to discuss submission of this information.

Inbreeding Calculator Available

To assist in the monitoring of inbreeding within the seedstock industry, the “Mating Predictor” facility that is available as part of the Internet Solutions Enquiry System has been enhanced to facilitate the calculation of the inbreeding coefficient for progeny from a specified mating. This provides seedstock breeders with an invaluable tool that enables them to carefully analyse and control the level of inbreeding that exists within their breeding animals.

The inbreeding calculator is now available within the Internet Solutions systems offered by the Australian Brach Breeders Association, Herefords Australia, Shorthorn Beef, Murray Grey Beef Cattle Society, Charolais Society of Australia, Australian Limousin Breeders Society, Australian Simmental Breeders Association, Australian Wagyu Association, South Devon Cattle Society of Australia, Blonde d’Aquitaine Society of Australia and New Zealand, and Angus Australia. It may become available in other breeds if these Breed Societies opt to take advantage of this facility.

In addition to the calculation of the inbreeding coefficient, the mating predictor also enables members to:

- Calculate the expected EBVs, EBV accuracies and selection index values of the progeny from a specified mating (or a range of possible matings).
- Display the full pedigree of the progeny from the specified mating (or a range of possible matings).
- Display the expected EBV graph against the percentiles bar chart for the progeny from a specified mating.

An example of the information provided by the mating predictor is displayed in the diagram below:

Any member that would like assistance in the use of the mating predictor (and associated inbreeding calculator) should contact staff at either SBTS, TBTS or BREEDPLAN.
Selection Index Update

A number of Breed Societies have either recently updated or are in the process of updating the selection indexes that are produced for animals within their breed.

- Shorthorn has conducted a complete review of their selection indexes. The existing Supermarket and Restaurant selection indexes will be combined into the one Heavy Domestic index, while the Export and SB3 Carcase indexes have been updated to ensure they are appropriate for current beef markets. The revised selection indexes have been scheduled for implementation in the upcoming 2010 Summer Shorthorn GROUP BREEDPLAN analysis.
- Charolais has released a new selection index in association with the results from the October 2009 Charolais GROUP BREEDPLAN analysis titled the Live Export selection index. The Live Export index estimates the genetic differences between animals in net profitability per cow joined for an example commercial herd in Northern Australia (e.g. Brahman cows) targeting the production of steers and heifers for the live export market (e.g. Indonesia). The existing Domestic and Export selection indexes were also updated to ensure that they were appropriate for current beef markets.
- South Devon has developed selection indexes for the first time. Three indexes have been developed, namely a Supermarket, Vealer and Export selection index. The selection indexes are due for implementation in the 2010 South Devon GROUP BREEDPLAN analysis in February.
- Brahman is investigating the development of a Live Export index, to join their existing Jap Ox selection index. No date has been set for the implementation of the new index.

Complete details of the new or updated selection indexes will be sent to all BREEDPLAN members from the respective breed at the time of implementation. Information will also be available from the tip sheet page in the technical area of the BREEDPLAN website (http://breedplan.une.edu.au).

Removal of Multibreed EBV Adjustment Table

As a result of recent changes that have been made to the BREEDPLAN analytical software, coupled with the updating of both the genetic parameters and genetic base within the GROUP BREEDPLAN analysis for several breeds, the Multibreed EBV adjustment table is no longer applicable and consequently, should no longer be used. The Multibreed EBV adjustment table was developed in 2003 and enabled producers to adjust Hereford, Angus, Simmental and Limousin EBVs to make them comparable across breeds. No decision has been made as to whether the adjustment table will be updated.

New HerdMASTER Tip Sheets Available

A range of new tip sheets have been developed for members that use HerdMASTER as their herd recording program. The tip sheets have been specifically developed to provide members with assistance in the use of HerdMASTER for their BREEDPLAN recording. The new tip sheets are available from the technical area on the BREEDPLAN website. Alternatively, paper copies of the tip sheet can be requested from the BREEDPLAN office.
Monthly Brahman & Charolais GROUP BREEDPLAN analyses

The Australian Brahman Breeders Association and Charolais Society of Australia have recently joined the Red Angus Society in upgrading the software used to manage their pedigree and performance database and are now using ABRI's new generation of breed registry software known as ILR2. The new software includes several new features such as the running of monthly GROUP BREEDPLAN analyses and production of enhanced BREEDPLAN reports. This will significantly enhance the BREEDPLAN service that is provided to members of Brahman and Charolais BREEDPLAN. It is anticipated that other Breed Societies will progressively upgrade to the ILR2 software over the coming years.

..................

New Charolais GROUP BREEDPLAN logo

The Charolais Society of Australia has developed a new Charolais GROUP BREEDPLAN logo. Members should ensure that any advertisements, sale catalogues, websites etc. are updated with the new logo. An electronic copy of the new logo can be accessed from the breed specific page within the technical area of the BREEDPLAN website (http://breedplan.une.edu.au) or by contacting staff at Charolais BREEDPLAN.

..................

Inaugural Wagyu GROUP BREEDPLAN Analysis

The first GROUP BREEDPLAN analysis for the Wagyu breed in Australia was completed in September. The GROUP BREEDPLAN analysis included performance information from 27 different Wagyu herds, with 4,145 sires and 38,487 dams represented. GROUP BREEDPLAN EBVs for Wagyu animals are now available via the EBV Enquiry facility on the Australian Wagyu Association website (alternatively, click on Database Search from the menu at the top of the BREEDPLAN website). Herds that participated in the GROUP BREEDPLAN analysis have also been sent reports containing the GROUP EBVs for their animals.

..................

Calving Ease EBVs released for Gelbvieh

The Gelbvieh GROUP BREEDPLAN analysis that was conducted in July included the calculation of Calving Ease EBVs for the first time. Gelbvieh animals that meet minimum accuracy thresholds will now have Calving Ease Direct and/or Calving Ease Daughters EBVs displayed in BREEDPLAN Herd Reports and on the Gelbvieh Internet Solutions facility. Any Gelbvieh BREEDPLAN member that is interested in having Calving Ease EBVs calculated for their animals is now encouraged to record calving difficulty scores. Further information is available in the tip sheet titled “Understanding Calving Ease EBVs” that is available from the technical area of the BREEDPLAN website or by contacting staff at either SBTS or BREEDPLAN.
Trial Shear Force EBV\textsuperscript{M}s for Brahman

The Trial Shear Force EBV\textsuperscript{M}s for Brahman have been recalculated, with 20,866 animals included in the revised analysis. The Trial Shear Force EBV\textsuperscript{M}s provide estimates of genetic differences between animals in meat tenderness. In contrast to the initial analysis that was conducted in October 2008, the new analysis was modified to include Pfizer Tenderness MVPs (in addition to the Pfizer “stars”), plus any additional gene marker and flight time information that had been collected. No additional shear force measurements had been collected since the first analysis was conducted. In addition to the Trial Shear Force EBV\textsuperscript{M}s, Trial Flight Time EBVs were also reported. Updated Trial Shear Force EBV\textsuperscript{M}s and Trial Flight Time EBVs have been sent to Brahman members that have collected information and have been made available from the EBV Enquiry system on the ABBA website.

Completion of First Phase of SBTS Project

December 31\textsuperscript{st} 2009 will mark the completion of the first four years of the Southern Beef Technology Services (SBTS) project. In conjunction with Tropical Beef Technology Services, the first four years have seen a great amount of activity in the extension of the genetic technologies that are available to the seedstock sector.

The major achievements of the SBTS project between 2006 – 2009 include:

- Delivery of 87 specific workshops (against the project objective of 64) primarily for the seedstock sector. All workshops were based on the utilisation of genetic tools for increasing the rate of genetic progress.
- Involvement in a further 44 broader industry events where SBTS was one presenter within a panel of speakers.
- Education to a combined audience of 4,517 beef breeders and industry service providers.
- Production and distribution of a bi-annual technical newsletter for seedstock producers.
- Complete revision of all BREEDPLAN extension material including the BREEDPLAN website.
- Provision of technical support via phone, email or on-property consultation to individual members of participating Breed Societies. 120 on-property consultations have been conducted since the project’s inception.
- Liaison on technical issues with participating Breed Society Boards and/or Technical Committees.

On behalf of the 14 participating Breed Societies (Herefords Australia Ltd, Shorthorn Beef, Murray Grey Beef Cattle Society, Charolais Society of Australia, Australian Limousin Breeders Society, Australian Simmental Breeders Association, Red Angus Society of Australia, Australian Wagyu Association, South Devon Cattle Society of Australia, Devon Cattle Breeders Society, Australian Red Poll Cattle Breeders Inc, Blonde d’Aquitaine Society of Australia and New Zealand Inc, Australian Salers Association and Australian Gelbvieh Association), SBTS is currently discussing the extension of funding for the project with Meat and Livestock Australia for a further 4 years. Angus Australia have also accepted an invitation to participate in the next phase of the project.

Subject to the success of the funding application, members from all breeds undertaking genetic evaluation through GROUP BREEDPLAN in Australia will be provided with structured and consistent education and technical support via either the SBTS or TBTS projects from 2010 onwards. As both projects are managed under the one umbrella, a truly national extension program for genetic technologies will be established for the Australian beef industry.